Impact of the College of Arts and Sciences Mathematics Tutorial Extension Program among the Grade Six Pupils in a Public Elementary School in the Division of Nueva Vizcaya

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ABSTRACT

The study aimed to evaluate the effectiveness of the seven-year old mathematics tutorial extension program of the College of Arts and Sciences (CAS). This was conducted in Bayombong West Elementary School (BWES), Nueva Vizcaya. The program started in 2006 in response to the mandate of the Nueva Vizcaya State University to expand its services by conducting extension work in the community. Primary data were collected from cooperating teachers, former and current principals, 114 pupil - clienteles and 10 randomly selected parents of the pupil-respondents. Secondary data were obtained from the BWES records and CAS Extension's records. Data were analyzed using descriptive statistics. Results revealed that the pupils' attendance to the program improved their academic performance in the National Assessment Test (NAT). Positive changes in the pupils' attitude and confidence level towards mathematics were also observed. Hence, the mathematics tutorial program of the CAS, in support to the regular classroom instruction, exhibited positive impact to grade six pupils in improving their academic performance and in imbibing positive attitude towards mathematics. The best practices of the program such as solving puzzles, quiz games and simulation examinations are highly recommended for use by other schools in order to improve pupils' academic performance and attitude towards mathematics.

INTRODUCTION

Mathematics performance is usually associated to learners' cognitive abilities. Luszczynska and Durawa (2012) noted that several psychological theories assume that self-regulation guides human behavior in various domains. As to mathematics learning, the complexity in understanding the nature of the subject requires high cognitive ability from the individual. Vygotsky (1987) explained that learners' interactions with his environment greatly contribute to his cognitive development. This means that the more that they are exposed to their environment, where activities and learning support their cognitive development, the higher the chance that they will understand the subject. Hence, in dealing with Mathematics, learner's exposure to his environment will help him understand the subject better. Beliavsky (2006) elaborated this idea as a teaching-learning process that allows educators to teach ahead of development, motivate and promote creativity and imagination, and encourage personal, social and academic growth through interactions. Further, understanding the nature of a subject could be associated to the learner's

attitude towards it; thus, if the learner has a positive outlook on the subject, the greater is the tendency that he/she excels in that subject (Fennema-Sherman, 1976).

The performance of the country in the international mathematics tests has been consistently declining annually as noted by Senator Manuel Roxas (2010). This is in accord with the results of mathematics subtests of Filipino students over the past years, based on Trends in Mathematics and Science Study (TIMSS) which showed that Filipino first year high school students ranked 40th out of 42 participating countries in the 1995 evaluation, and 36th out of 38 in 1999. In 2003, Filipino Grade 4 pupils ranked 23rd out of 25 participating countries, while the second year high school students placed 41st out of 45 participating countries (Tan, 2008). This prompted the education sector to institute several reforms such as curriculum revisions from Secondary Education Development Program (SEDP) to Basic Education Curriculum (BEC), then to Revised Basic Education Curriculum (RBEC) and now, the K12. The education sector likewise implemented some initiatives like Science and Technology content trainings, pedagogy seminars, and test and measurement seminars. They also devised books, manuals and exercises distributed to all public schools.

On the part of the parents, especially those who belong to the well-to-do families, they enrolled their sons/daughters to out-of-school interventions like tutorials, advanced and review classes to ensure that their children really understand the lessons and perform well in examinations. In the study of Van Veggel (2014), the out-of-school classes or tutorial classes to support the learning of students during regular class discussions were noted effective. The DepEd likewise launched their Mathematics Teachers Association of the Philippines (MTAP) classes which aimed to give advance lectures to elementary and high school learners. However, this activity is only good for six sessions, scheduled during Saturdays from November to December with a corresponding P 200.00 enrollment fee.

The College of Arts and Sciences Math tutorial program therefore aimed to help pupils with their performance in their mathematics classes by providing free review and advanced lectures every Saturday to support the weekly topics discussed by the mathematics teachers during their regular school days. The program was launched in June 2006 and was implemented in Bayombong West Elementary School (BWES) located at Barangay San Nicolas, Bayombong, Nueva Vizcaya for seven years. The researcher investigated the impact of this tutorial program on the cognitive and attitude changes of the learners towards mathematics, and the school's NAT performances. Best practices were also determined during implementation of the tutorial program, which are believed to be helpful in sustaining the program.

METHODOLOGY

One hundred fourteen pupil-clienteles were the respondents of this study. These respondents attended the opening program and orientation. Although some did not pursue the tutorial lesson, most of them completed the sessions during the school years 2011 – 2012, 2012 – 2013, and 2013 – 2014. Other respondents were two cooperating teachers, the tutors during the school years mentioned, and the principals of the school. Ten randomly selected parents of the pupil-respondents were also respondents of the st udy.

There were two sets of instruments used in the study. The first instrument was used to gather the respondents' attitude towards mathematics which was administered as pre-test, before the tutorial started. To measure skill change of the respondents, indicators were used to reflect the respondents' skills and confidence towards mathematics. On the other hand, the second instrument was an achievement test which was administered as post-test after the tutorial lesson. The researcher made used of guide questions which elicited information

through interviews with selected parents, the two cooperating teachers and the school principals at the time of the study. In some cases, additional documents were retrieved from the BWES to obtain tangible records of the grade six pupils of the previous seven years to determine the pupils' performances in inter-school quiz bees, passing the Philippine Science High School Admission Test, individual NAT ranking, and MTAP performances.

The procedure for extension program analysis developed by Deshler (1999) was adopted to determine the impact of the tutorial program. Three main indicators included in the analysis were: cognitive change, attitude change, and satisfaction level. According to the author, positive changes in the learner must be established to claim that a program's impact is positive.

Descriptive statistics such as mean and rate of change were used to establish positive change on the clientele's achievement test scores conducted in the pre-test and post-test. To determine the relationship between the pupils' attendance to the tutorial program and their performance in the NAT–math portion, the Pearson Product Moment Correlation Coefficient R was used. The respondent's confidence and attitude towards Math were measured using the Fennema-Sherman Math Attitude Scale.

The Mean Percentage Score (MPS) is the ratio between the number of correctly answered items and the total number of test questions or the percentage of correctly answered items in the National Achievement Test Mathematics subtest (DepEd, 2011).

RESULTS AND DISCUSSION

Conduct of Tutorial Services

The CAS mathematics tutorial extension program was implemented for seven years, from school year 2006-2013, among the grade six pupils of each school year. Faculty members of the CAS Mathematics and Statistics department served as tutors for the first year of implementation, along with senior BS Math students on its second year. On the third to sixth year of implementation, BS Math senior students of the Mathematics Club together with their club advisers served as tutors. They were joined by third year BS Math students on the last year of implementation. No monitoring and supervision were done during the first two years because the program was implemented by the faculty themselves. In the succeeding years, the club advisers monitored and supervised implementation of the program and were evaluated by the Chairman of the Mathematics and Statistics Department, College Extension Coordinator and College Dean. Faculty members shouldered expenses incurred in the first two years, while the Math Club sourced out funds for the remaining years of the program through solicitations, partnerships with different organizations and by conducting income generating activities like Bingo Socials in the University. There were only four lecture sessions during the first year of implementation. However, during the succeeding years, lectures were scheduled every Saturday from June to December. Strategies used included games, puzzles, lectures supplemented with books from the LGU and quizzes. NAT simulation examinations were conducted every Saturday from January to February each year before the pupils took the NAT and tutor was assigned for every five pupils. Tutorial kits (plastic envelope, paper, pencil, ball pen, notebook) were provided to the pupils on the third to the last year of the program. As an incentive for the pupils, medals and tokens were awarded to the top 10 best performing students for each year of implementation, and tokens were given to performing students for each activity. The tutors, in return, received certificates of appreciation from BWES at the end of each year.

Changes indicators attributed to the conduct of the Math tutorial program

Clienteles' academic performance. Few sessions were conducted during the first year of the program. The cooperating teachers did not observe any change in the academic

performance of the pupils during the first year. However, when the number of tutorial days were increased to every Saturdays in the next school years, a remarkable improvement in the academic performance of the pupils was noted. Pupils who regularly attended the tutorial sessions could easily grasp new concepts posted, could easily cope up with lessons missed if they were absent for a day or more, exhibited competitive behaviour during recitations and board works, and in general, pupils showed progress in their academic subject.

Table 1 reflects the mean scores of the pupil-respondents in the pre-test and post-test during the school years 2011 – 2012, 2012 – 2013 and 2013 – 2014. The observations and claims of the cooperating teachers presented above were strengthened by the computed percentage increases. Results show that the performances of the pupil-respondents in the pre-test and post-test in the three batches exhibited positive increase. During the school year 2011 – 2012, the percentage increase of post-test from pre-test was 43.56%, while 31.41% for 2012 – 2013 and 45.83% for 2013 – 2014. Although the mean scores during the pre-tests and post-tests fall below 50% of the 60-item test, increase in the post-test mean scores were noticeable which implies improvement on the clienteles' academic performance. This concurs with the conclusion of Van Veggel (2014) that attendance in tutorial classes improves the academic performance of students.

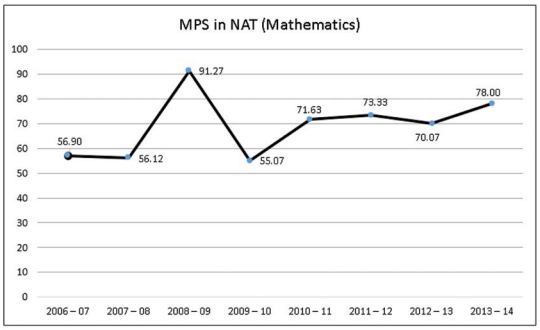

Figure 1. BWES National Achievement Test (NAT) – Mathematics Subtest results for School Years 2006 to2014.

School performance in the NAT. The Mean Percentage Score (MPS) of pupils of BWES in the National Achievement Tests – Mathematics subtest from 2006 to 2014 are presented in Figure 1. As could be observed from the figure, the MPS of BWES pupils in NAT (Mathematics) has an increasing trend.

In SY 2006–2007 and SY 2007-2008, the pupils' performances in the NAT were 56.90% and 56.12%, respectively. In SY 2008–2009, the pupils' mean score was 91.27% making the school second in mathematics among all elementary public schools in Nueva Vizcaya. Two pupils obtained perfect scores in mathematics. However, this was not sustained in SY 2009–2010 as the mean score dropped to 55.07%. Because of the low results, math club officers and tutors simulated the best practices of the tutors in SY 2008–2009. The best practices include providing free kits, giving tokens to performing pupils in every

Table 1. Performance in the Mathematics Pre-test and Post-test for three consecutive years

School Year	Pre-test Mean Scores	Post-test Mean Score	% of increase
2011 – 2012	17.57	25.23	43.56
2012 – 2013	18.59	24.42	31.42
2013 – 2014	16.87	24.60	45.83

activity for each lesson, and awarding medals to the top 10 performing pupils for the whole duration of each program. These practices were believed to have positive effect among the pupil respondents. The respondents became more participative to the activities of the program, and the weekly number of attendees had improved. As a result, the school made another leap in their NAT performance to 71.63% in SY 2010–2011. The practices were then maintained throughout the following years; hence, the school's NAT performance was consistently maintained at >70%.

Clienteles' confidence level in mathematics and attitude towards the subject. The indicators of skill change in mathematics are presented in Table 2.

BWES pupils showed positive improvements based on the indicators of skill change included. The rates of increase were all positive from 22.92% to 57.97%. The proficiency in computation had the biggest rate of increase from 2.76 to 4.36 which is equivalent to 57.97% increase. While the proficiency in working with a puzzle had the smallest rate of increase from 3.84 to 4.38 which is equivalent to 22.92% increase. The over-all mean score before the tutorial lesson was 3.30 which increased to 4.52 mean score after the tutorial. The over-all rate of change is equivalent to 37.11% increase.

After the tutorial program, BWES pupils have improved confidence level and attitude towards mathematics. Most of the indicators had NAD (Neither Agree or Disagree) levels before the start of the tutorial class and these levels changed to A (Agree) or SA (Strongly Disagree) levels after the program. Confidence in solving problems on board, proficiency in computation and performing math operations obtained the highest percentages of increase. These can be attributed to the interactive activities integrated in the lectures wherein almost all of the pupils were excited to solve puzzles and were always looking forward for more similar activities. The findings were validated by interviews conducted among the pupils and cooperating teachers. Interview data revealed that the mathematics tutorial program was effective in introducing changes in the attitude and confidence of the pupils toward the subject.

Table 2. Clienteles' confidence level in mathematics and attitudes towards the subject before and after the mathematics tutorial program.

Indicator	Pre-test		Post-test		% of Increase
	Mean	Level	Mean	Level	
BWES Pupils…					
1. are proficient in computation	2.76	NAD	4.36	A	57.97
2. can comprehend math word problems	3.14	NAD	4.24	A	35.03
3. can put math results into graphs and tables	3.26	NAD	4.38	A	34.36
4. can work on puzzles	3.84	A	4.72	SA	22.92
5. can perform the needed math operations	3.36	NAD	4.64	SA	38.10
6. have self confidence in solving problems on the board	3.42	NAD	4.84	SA	41.52
Over-all	**3.30**	**NAD**	**4.52**	**SA**	**37.11**

Legend: 1.00 – 1.49 (SD – Strongly Disagre) 4.50 – 5.00 (SA - Strongly Agree)
1.50 – 2.49 (D – Disagree) 2.50 – 3.49 (NAD – Neither Agree or Didagree)
3.50 – 4.49 (A – Agree)

This finding agrees with the findings of Van Veggel (2014) that small group tutorials can enhance students' confidence in mathematics which, in turn, can improve students' academic performance.

Relationship of frequency of attendance in the math tutorials to pupils' NAT performance

Table 3 presents the frequency distribution of the correlation coefficient r of the number of attendance and NAT scores of the pupils for school year 2011 to 2014. There were twenty pupils who attended the opening and launching of the tutorial program but were not able to attend any of the scheduled tutorial days. On the other hand, the other 94 pupils had attendance of one to fifteen tutorial days.

The correlation coefficient r (0.4890) together with the significance value (<0.01) suggest that frequency of attendance of the pupils is significantly related to their math scores in the NAT. The r2-value (0.2392) indicates that 24% of the pupils' performance could be attributed to their attendance in the tutorial program. The remaining 66% of the pupils' performance in the NAT can be attributed to other contributory factors such as regular classroom sessions, and home and peer influences. This finding implies that the more frequent the pupils' attendance in the math tutorial, the higher is their mastery of mathematics computation skills and strategies, and eventually higher math scores in the National Assessment Test. The cooperating teachers and principals also noted that the math tutorial program helped a lot in uplifting the quality of math education of their grade six pupils.

CONCLUSION AND RECOMMENDATION

The Math Tutorial program had a positive impact on the grade six pupils of BWES. It is a good intervention to support the mathematics program of the BWES. The program helped improve and maintain the school's NAT performance, and helped the pupils imbibe a positive attitude towards Mathematics.

The following practices are believed to be factors that made the tutorial program effective and sustainable:

1. Practices in the conduct and implementation of the program that encouraged pupils to attend the tutorials such as:

Table 3. Frequency distribution and correlation coefficient r of the frequency of attendance and the NAT scores of the pupils SY 2011 - 2014

Frequency of attendance	Number of pupils	NAT score
0	20	65.28
1 – 3	18	72.58
4 – 6	21	73.95
7 – 9	23	75.29
10 – 12	20	77.20
13 – 15	12	82.69
Total	**114**	**100.00**
Correlation coefficient (r) = 0.4890 * MPS (2012): 73.33%	Sig. = <0.01 MPS (2013): 70.07%	r^2 = 0.2392 MPS (2012): 78.00%

* - *significant*

- Free kits for the clienteles
- Free gift items for performing pupils in every activity for each lesson
- Medals for top 10 performing pupils for the whole duration of the tutorials

2. Regular monitoring and supervision of the program strengthened by involving other faculty members of the mathematics and statistics department, department chair, college extension coordinator and the dean.
3. Design of the tutorial follows reviews and advance classes scheduled from June to December and NAT simulation tests from June to February.

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